IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:	
Barin Geoffry Haskell, et al.	Confirmation No.: 4607
Serial No.: 10/664,985	Atty. Ref.: 112183-CON-1
Filed: September 18, 2003	Art Unit: 2613
FOR: NON-LINEAR QUANTIZER FOR VIDEO CODING	Examiner: Anand S. Rao

AMENDMENT

Mail Stop: AMENDMENT
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Sir:

Responsive to the non-final communication dated January 31, 2006, kindly consider the following Amendments and Remarks.

Amendments **to the Claims** begin on page 2 of this paper.

Remarks begin on page 13 of this paper.

Amendments to the Claims:

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

35. (currently amended) An encoder for encoding video signals, comprising:

a processing circuit to generate blocks of video data from a video information signal;

a transform circuit to generate DC luminance coefficients, DC chrominance coefficients, and AC chrominance coefficients for each of said blocks;

a quantizer circuit to:

- receive a quantization parameter for at least one ~~each~~ of said blocks~~,~~;
- scale a ~~said~~ luminance coefficient ~~coefficients~~ by a luminance scaling function **Q**$_{luminance}$ (p), that is at least three-segment piece-wise linear function, where p is a coefficient value;
- scale a ~~said~~ chrominance coefficient ~~coefficients~~ by a chrominance scaling function **Q**$_{luminance}$ (p), that is at least three-segment piece-wise linear function; and
- quantize said luminance coefficient according to said luminance scaling function~~,~~ and quantize said chrominance coefficient ~~coefficients~~ according said chrominance scaling function ~~transformation of said quantization parameter, each said quantization parameter being a function of a given channel transmission rate and at least one factor that affects number of bits that are allocated to coding said block~~; and

a variable length coder to generate a variable length code based on the quantized luminance and chrominance coefficients.

36. (currently amended) The encoder of claim 35, wherein said luminance and chrominance scaling functions are independent of variables other than p.

37. (currently amended) The encoder of claim 35, wherein:

at low values of said quantization parameter, ~~both~~ said luminance scaling function and said chrominance scaling function approximate constant scaling functions~~,~~; and

at high values of said quantization parameter said luminance scaling function approximates 2 times said quantization parameter~~,~~ and said chrominance scaling function approximates said quantization parameter.

38. (currently amended) The encoder of claim 37, wherein a result ~~where value~~ of said ~~chrominance~~ luminance scaling function for a given coefficient level, *p*, is lower than a result ~~value~~ of said chrominance scaling function for said given coefficient level~~, for all coefficient levels~~.

39. (currently amended) The encoder of claim 37, wherein said quantizer divides DC luminance coefficient *p* by the value of said luminance scaling function at p, and divides said DC chrominance coefficient *p* by the value of said chrominance scaling function at *p*.

40. (currently amended) A decoder for decoding encoded video signals, comprising:

a variable length decoder to generate quantized video coefficients from variable length code contained within the encoded video signals~~,~~;

a dequantizer circuit to identify a quantization parameter *Q(p)*~~, with~~ for each block associated with the encoded video signals and to dequantize the video coefficients according to an at least three-segment piece-wise linear transformation of the quantization parameter~~,~~;

an inverse transform circuit that ~~derives a DC luminance dequantization parameter from said quantization parameter, to transform~~ transforms the dequantized video coefficients into blocks of video data~~,~~; and

a processing circuit to generate a video signal from the blocks of video data.

41. (Original) The decoder of claim 40, wherein:

the encoded video signals contain encoded luminance signals;

the variable length decoder to generate quantized luminance coefficients based on the variable length code;

the dequantizer circuit to dequantize the luminance coefficients;

the inverse transform circuit to generate blocks of luminance data from the luminance coefficients; and

the processing circuit to generate a luminance signal from the blocks of luminance data.

42. (Original) The decoder of claim 40, wherein:

the encoded video signals contain encoded DC chrominance signals;

the variable length decoder to generate quantized DC chrominance coefficients based on the variable length code;

the dequantizer circuit to dequantize the DC chrominance coefficients;

the inverse transform circuit to generate blocks of DC chrominance data from the DC chrominance coefficients; and

the processing circuit to generate a DC chrominance signal from the blocks of DC chrominance data.

43. (Original) The decoder of claim 40, wherein:

the encoded video signals contain encoded AC chrominance signals;

the variable length decoder to generate quantized AC chrominance coefficients based on the variable length code;

the dequantizer circuit to dequantize the AC chrominance coefficients;

the inverse transform circuit to generate blocs of AC chrominance data from the AC chrominance coefficients; and

the processing circuit to generate a AC chrominance signal from the blocks of AC chrominance data.

44 - 49. (cancelled)

50. (currently amended) A video coding system, including:

a video encoder comprising:

means for generating blocks of video data from a received video signal~~,~~ and transforming ~~transforms~~ the blocks of video data into representative video coefficients~~,~~;

means for quantizing the video coefficients according to an at least three segment piece-wise linear transformation of a received quantization parameter Q_p~~,~~;

means for generating an encoded video signal based on the quantized video coefficients~~,~~; and

means for outputting the encoded video signal to a channel; and

a video decoder comprising:

means for generating quantized video coefficients from the encoded video signal received from the channel~~,~~;

means for identifying the quantization parameter Q, associated with the encoded video signal;

means for dequantizing the quantized video coefficients according to an at least three segment piece-wise inverse linear transformation of the identified quantization parameter Q_p~~,~~;

means for transforming the dequantized video coefficients into blocks of video data~~,~~; and

means for generating a representation of a video signal from the blocks of video data.

51. (Original) The video coder of claim 50, further comprising:

means for embedding a quantization parameter update in a fixed length code within the encoded video signal, the code representing a change in the quantization parameter with reference to a previous value of the quantization parameter; and

means for updating the quantization parameter based on the quantization parameter update.

52 – 55 (cancelled).

56. (currently amended) A decoding method for a coded image data signal, the coded image data signal including data of a plurality of macroblocks and further of a plurality of blocks that are members of the macroblocks, each macroblock including up to four luminance blocks and up to two chrominance blocks, the method comprising:

decoding coded intra macroblock data by:

identifying from the signal quantization parameter data for the macroblock~~,~~;

generating a luminance scalar according to a first piece-wise linear transformation of the quantization parameter~~,~~;

generating a chrominance scalar according to a second piece-wise linear transformation of the quantization parameter~~,~~;

for each of up to four luminance blocks that are members of the macroblock, inverse quantizing a DC coefficient of the luminance block by the luminance scalar~~,~~;

for each of up to two chrominance blocks that are members of the macroblock, inverse quantizing a DC coefficient of the chrominance block by the chrominance scalar~~,~~;

transforming data of the blocks, including the respective inverse quantized DC coefficient, according to an inverse discrete cosine transform~~,~~; and

merging data of the blocks to generate image data of the macroblock.

57. (currently amended) The decoding method of claim 56, wherein coded image data signal identifies, for at least one macroblock, ~~is~~ a differential update, representing a change in the ~~quantization parameter over a~~ quantization parameter from a previously-coded macroblock.

58. (Original) The decoding method of claim 56, further comprising, prior to the inverse quantizing, predicting a scaled DC coefficient of a block according to a gradient prediction analysis.

59. (currently amended) The decoding method of claim 56, further comprising, responsive to a first state of a prediction flag, decoding an AC coefficient signal in the coded image data signal a residual signal according to an AC prediction process.

60. (currently amended) The decoding method of claim 59, further comprising, responsive to a second state of the prediction flag, decoding the AC coefficient signals ~~signals~~ according to an inverse discrete cosine transform.

61. (currently amended) An image coding method, comprising:

identifying luminance and chrominance components of an image data signal~~,~~;

organizing spatial areas of the image data signal into macroblocks and further to blocks, wherein a macroblock includes up to four blocks of luminance data and two blocks of chrominance data~~,~~;

transforming each luminance block and each chrominance block according to a discrete cosine transform to generate ~~, generating~~ DCT coefficient data for each block~~,~~;

for each macroblock:

determining a quantizing parameter~~,~~;

generating a luminance scalar based on a piece-wise linear transform of the quantizing parameter~~,~~;

generating a chrominance scalar based on a piece-wise linear transform of the quantizing parameter~~,~~;

scaling a DC coefficient of each luminance block according to the luminance scalar~~,~~;

scaling a DC coefficient of each chrominance block according to the chrominance scalar~~,~~; and

transmitting an identifier of the quantization parameter and each scaled DC coefficient via a channel.

62. (currently amended) The method of claim 61 ~~57~~, wherein the identifier of the quantization parameter for at least one macroblock is a differential update, representing a change in the ~~quantization parameter over a~~ quantization parameter from a previously-decoded ~~previously-coded~~ macroblock.

63. (currently amended) The method of claim <u>61</u> ~~57~~, further comprising predicting a scaled DC coefficient of a block from a gradient prediction analysis, wherein the identifier of the respective DC coefficient represents results of the prediction.

64. (currently amended) The method of claim <u>61</u> ~~57~~, wherein the discrete cosine transform generates AC coefficients for at least one block, the method further comprising:

transmitting the AC coefficients of the block.

65. (currently amended) The method of claim <u>61</u> ~~57~~, wherein the discrete cosine transform generates AC coefficients for at least one block, the method further comprising:

predicting AC coefficients of the block~~,~~<u>;</u>

generating AC residuals for the block~~,~~<u>;</u> and

transmitting the AC residuals.

66. (currently amended) The method of claim <u>61</u> ~~57~~, further comprising transmitting a ~~flag~~ signal for a block to indicate whether AC coefficients or AC prediction <u>residuals</u> ~~residual of the block~~ are to be transmitted.

67. (Currently Amended) An image coder comprising:

an image preprocessing circuit to identify, from an image signal, luminance and chrominance components thereof ~~an~~ <u>and</u> to organize the image signal into macroblocks and blocks <u>thereof</u>, each macroblock having up to four luminance blocks and up to two chrominance blocks~~,~~<u>;</u>

a DCT circuit, to generate from respective blocks identified by the image preprocessing circuit coefficient data of the blocks according to a discrete cosine transform~~,~~<u>;</u> and

a quantizer to quantize DC coefficients blocks within each macroblock according to a quantization parameter assigned to the macroblock, wherein DC coefficients of luminance blocks are scaled according to a first piece-wise linear transform of the quantization parameter, and DC coefficients of chrominance blocks are scaled according to a second piece-wise linear transform of the quantization parameter.

68. (currently amended) The image coder of claim 67, further comprising:

a predictor to predict DC coefficient data of the blocks according to a gradient prediction analysis~~,~~; and

a variable length coder coupled to the predictor.

69. (currently amended) An image decoder, to decode a coded data signal, the signal identifying coded data for a plurality of macroblocks, each macroblock including coded data for up to four luminance blocks and up to two chrominance blocks, the ~~coded data~~ signal including an identifier of a quantization parameter for at least some of the macroblocks ~~each macroblock~~, the decoder comprising:

a scalar to inverse quantize scaled DC coefficients of the blocks, wherein:~~,~~

~~wherein~~ a DC coefficient of each luminance block is inverse quantized according to a luminance scalar generated from a piece-wise linear transformation of the quantization parameter for the ~~to which the respective~~ luminance block ~~belongs,~~; and

~~wherein~~ a DC coefficient of each chrominance block is inverse quantized according to a chrominance scalar generated from a piece-wise linear transformation of the quantization parameter for the ~~to which the respective~~ chrominance block ~~belongs,~~;

an inverse transform circuit to perform an inverse discrete cosine transform of the blocks, including the inverse quantized DC coefficients~~,~~; and

a post-processing circuit to generate reconstructed image data from the inverse transformed block data.

70. (currently amended) The image decoder of claim 69, further comprising:

a variable length decoder~~,~~; and

a prediction circuit to predict ~~predicted~~ the DC coefficient data for the blocks according to a gradient prediction analysis.

REMARKS

Reconsideration and allowance are requested. Claims 44 – 49 and 52 – 55 are cancelled without prejudice or disclaimer. The amended claims are amended to clarify claim language or typographical error and to improve punctuation. No claim amendments are made for patentability.

Rejection of claims 44-49 and 52-55

On page 2 of the Office Action, the Examiner has rejected claims 44-49 and 52-55 under 35 U.S.C. 102(b), as being anticipated by Kato (USP 5,559,557). Applicants have cancelled these claims thus rendering this rejection moot.

Rejection of claims 35-43, 50-51 and 56-70

The Examiner rejects claims 35-43, 50-51 and 56-70 under 35 U.S.C. 103(a) as allegedly being unpatentable over Kato in view of Azadegan, et al. (USP 5,612,900) ("Azadegan"). Applicants traverse this rejection and submit that one of skill in the art would not have sufficient motivation or suggestion to combine Kato with Azadegan.

To establish a *prima facie* case of obviousness, the Examiner must meet three criteria. First, there must be some motivation or suggestion, either in the references themselves, or in the knowledge generally available to one of ordinary skill in the art, to combine the references. Second, there must be a reasonable expectation of success, and finally, the prior art references must teach or suggest all the claim limitations. The Examiner bears the initial burden of providing some suggestion of the desirability of doing what the inventor has done. "To support the conclusion that the claimed invention is directed to obvious subject matter, either the references must expressly or impliedly suggest the claimed invention or the examiner must

present a convincing line of reasoning as to why the artisan would have found the claimed invention to have been obvious in light of the teachings of the references." MPEP 2142.

If the proposed modification or combination of the prior art would change the principle of operation of the prior art invention being modified, then the teachings of the references are not sufficient to render the claims *prima facie* obvious. *In re Ratti*, 270 F.2d 810, 123 USPQ 349 (CCPA 1959). Furthermore, if the examiner determines there is factual support for rejecting the claimed invention under 35 U.S.C. 103, the examiner must then consider any evidence supporting the patentability of the claimed invention, such as any evidence in the specification or any other evidence submitted by the applicant. The ultimate determination of patentability is based on the entire record, by a preponderance of evidence, with due consideration to the persuasiveness of any arguments and any secondary evidence. *In re Oetiker*, 977 F.2d 1443, 24 USPQ2d 1443 (Fed. Cir. 1992). The legal standard of "a preponderance of evidence" requires the evidence to be more convincing than the evidence which is offered in opposition to it. With regard to rejections under 35 U.S.C. 103, the examiner must provide evidence which as a whole shows that the legal determination sought to be proved (i.e., the reference teachings establish a *prima facie* case of obviousness) is more probable than not. MPEP 2142.

The test for obviousness is what the combined teachings of the references would have suggested to one of ordinary skill in the art, and all teachings in the prior art must be considered to the extent that they are in analogous arts. Where the teachings of two or more prior art references conflict, the examiner must weigh the power of each reference to suggest solutions to one of ordinary skill in the art, considering the degree to which one reference might accurately discredit another. *In re Young*, 927 F.2d 588, 18 USPQ2d 1089 (Fed. Cir. 1991) MPEP 2143.01.

The mere fact that references <u>can</u> be combined or modified does not render the resultant combination obvious unless the prior art also suggests the desirability of the combination. *In re Mills*, 916 F.2d 680, 16 USPQ2d 1430 (Fed. Cir. 1990). MPEP 2143.01.

With these principles in mind, we turn to the attempt to combine the Kato with Azadegan. The Examiner concedes that Kato fails to disclose using an at least three segment piece-wise linear function but asserts that because Azadegan discloses a piece-wise linear scaling function "in order to insure that acceptable picture quality is maintained across coded regions" that it would have been obvious to incorporate Azadegan's piece-wise linear scaling function into Kato. Applicants submit that by a preponderance of the evidence, one of skill in the art would not be motivated to combine Kato with Azadegan for the purpose of insuring acceptable picture quality across coded regions.

One reason for this lack of motivation is that Kato continuously discusses and teaches that his quantizer and dequantizer are linear. Several examples include:

- "The DCT circuit 2 is adapted to orthogonally transform each block of 8 pixels x 8 lines into a block of DCT coefficients (c1) which is applied to a quantizer 3 that linearly quantizes the DC component coefficient of each block using a predetermined quantization set width ...." Col. 2, lines 38 – 43.
- "In the MPEG1 technique, a value with this 11-bit precision always undergoes a linear quantization process for transformation into an 8-bit number in the range 0 to 255...." Col. 3, lines 59 – 62;
- "A DCT circuit 61 is adapted to orthogonally transform blocks of pixels representing a picture into 8x8 blocks of DCT coefficients, and to supply the DCT coefficients to a quantizer 62 which functions to linearly quantize the DC component coefficients...." Col. 7, lines 25 – 29.
- "An inverse quantizer 83 is adapted to receive the recovered quantized DC component coefficients and to apply an inverse-linear-quantization process thereto...." Col. 9, lines 59 – 61.

- "In the case MPEG data, linear inverse quantization is normally carried out in the inverse quantization unit 502 and a value equal to half the inverse quantization S18 is added as an offset to a result obtained from the linear inverse-quantization." Col. 17, 25 – 29.
- "In the case of MPEG data, linear inverse quantization is normally carried out." Col. 17, lines 40-41.
- "The DC coefficient inverse quantization unit 504 is adapted to linearly inverse quantize the DC coefficients S504 in accordance with the inverse quantization step signal S508." Col. 17, lines 57 – 60.

As mentioned by the Examiner, Kato does refer to a flag that turns off linear dequantization into non-linear dequantization. Col. 13, line 23. After introducing this idea of using either linear or non-linear, there is little if any discussion of the non-linear quantization with reference to FIG. 15. Col. 12, line 56 – col. 13, line 25. Kato basically states that the qscale_type flag can turn off linear dequantization and turn on non-linear dequantization but there are not any details beyond that.

Applicants therefore highlight with the above citations to the Kato reference that it clearly teaches linear quantization and dequantization. The Examiner seeks to establish that it would be obvious to replace the linear quantization process of Kato with one that is step-wise linear. As discussed above, the blending of these references would violate the principle wherein if a proposed modification or combination of the prior art would change the principle of operation of the prior art invention being modified, then the teachings of the references are not sufficient to render the claims *prima facie* obvious. In this case, the modification involved is the change of the quantization in Kato from being linear or non-linear to being step-wise linear. Therefore, since the principle of operation is modified in Kato, there is insufficient motivation or suggestion to combine these references.

The Examiner also asserts that it would be obvious to utilize Azadegan's piece wise linear function for ensuring an acceptable picture quality across coding regions. This benefit that the Examiner asserts is not found in Kato does already exist in that reference. Specifically, Kato teaches receiving a picture quality signal which may correspond to a video sequence, group of pictures, picture, slice, macroblock or block portion of the video signal. The video signal is orthogonally transformed to produce direct current component coefficients, and the direct current component coefficients are quantized using the selected encoding precision. Col. 4, lines 34 – 44. Importantly, as the detailed description of the Kato patent description begins, Kato explains that "the number of quantization bits used for encoding DCT DC component coefficients can be increased with an increase in required picture quality." Col. 6, lines 6 – 8.

Therefore, as one of skill in the art reviews Kato, that person would see that the Kato teaches a system wherein quantization may be done using a selected encoding precision which results in an increase in the number of bits used for encoding to increase the picture quality. This increase may be at the sequence, group of pictures, picture, slice, macroblock or block portion of the video signal. Col. 4, lines 42 – 44. In sum, Applicants submit that Kato already teaches and explicitly recites that his method provides for an acceptable picture quality throughout the block, macroblock, picture etc. Therefore, one of skill in the art reading Kato would not be motivated to look elsewhere for ensuring "that acceptable picture quality across coding regions is maintained" because that benefit is already explicitly provided by the disclosure of Kato.

Because Kato teaches that his method provides for an increased in picture quality across a block, macroblock and so forth, and that increased picture quality requires a linear quantization/dequantization process, Applicants respectfully submit that one of skill in the art would not, by a preponderance of the evidence, combine Kato with Azadegan.

Therefore, for at least the foregoing reasons, Applicants submit that Kato should not be combined with Azadegan because (1) such a combination requires the modification of Kato from

a linear quantization process as taught to a step-wise linear process which changes the principle of operation of the reference; and (2) the benefit articulated by the Examiner of ensuring picture quality across coding regions is already expressly taught in Kato and thus one of skill in the art would believe that the Kato method would provide that benefit. This prevents the existence of a sufficient amount of motivation and certainly no suggestion to look elsewhere. Inasmuch as the standard is only by a preponderance of the evidence, Applicants submit that on the balance, there is more evidence against the motivation to combine in the record than there exists to combine.

Accordingly, since the combination of Kato and Azadegan are cited to reject claims 35 – 43, 50 – 51 and 56 – 70, Applicants submit that these claims are patentable and in condition for allowance.

CONCLUSION

Having addressed the rejection of claims, Applicants respectfully submit that the subject application is in condition for allowance and a Notice to that effect is earnestly solicited.

Respectfully submitted,

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